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PRototype Integrated DEsign (PRIDE) System
Reference Manual
Volume 2
Schema Definition

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I. SUMMARY

An initial description of an evolving relational database schema is presented for the management of finite element model design and analysis data. The report presents a description of each relation including attribute names, data types, and definitions. The format of this report is such that future modifications and enhancements may be easily incorporated.

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II. INTRODUCTION

This report represents the second volume in a three volume set describing the PRIDE (PRototype Integrated DEsign) system (ref. 1 and 2). The three volumes are described below:

Volume 1: PRIDE User's Manual -
Contains a description of the user interface to the PRIDE software (applications programs and associated pre- and post-processors).

Volume 2: PRIDE Reference Manual -
Contains a description of the relational database schema which forms the global basis for the integrated PRIDE system software.

Volume 3: PRIDE Programmer's Manual -
Contains system information on the pre- and post-processor software that is relevant to individuals requiring an in-depth description of the PRIDE internals.

Given the large quantities of design and analysis data present in most engineering applications, it is desirable to find methods for adequately managing the data. A relational data model (ref. 3) was chosen as a basis for handling engineering data since the relational model promotes a simple-to-use and effective query mechanism. The RIM (Relational Information Manager) database management system (ref. 4) is being used within PRIDE. RIM is an outgrowth of the IPAD contractual development (ref. 5). It has been applied by integrating several engineering application programs with the RIM data manager to form the PRIDE system.

The user's relational database is used for managing data and serves as the focal point during design and analysis. All of the engineering application programs are directly integrated with the database using the RIM FORTRAN program interface subroutines, so that the database serves as the global exchange and manipulation mechanism. An example of the role that the relational database management system plays in an integrated design system is depicted in figure 1.

This report describes the schema (a set of two-dimensional tables, called "relations") of the database currently implemented within PRIDE. Each relation is composed of a set of tuples (or rows) and a set of attributes (or columns). More detailed information concerning schemas and relations using RIM may be obtained from reference 4.

III. ARCHIVAL DATA

A. MATERIAL PROPERTIES

Relation Name: "MAT-PROP"

Description: Temperature independent material properties

Relation contents:

Attribute Name	Type	Contents
MATERIAL	TEXT 8	Material name
SPEC-WT	REAL	Specific Weight
YIELD-TE	REAL	Yield in Tension
YIELD-CO	REAL	Yield in Compression
YIELD-SH	REAL	Yield in Shear
ULT-TENS	REAL	Ultimate in Tension
ULT-COMP	REAL	Ultimate in Compression
ULT-SHER	REAL	Ultimate in Shear
ENDU-LIM	REAL	Endurance Limit
MOD-ELAS	REAL	Modulus of Elasticity
MOD-RIGI	REAL	Modulus of Rigidity
THERMCOE	REAL	Thermal Coefficient
SPECHEAT	REAL	Specific Heat
CONDUCT	REAL	Conduction Coefficient
EMISSIV	REAL	Emissivity
ABSORP	REAL	Absorptivity
DIFFCOMP	REAL	Diffuse Component

III. ARCHIVAL DATA

B. WIDE FLANGE BEAMS

Relation Name: "WFL"

Description: Wide flange beam data

Relation contents:

Attribute Name	Nype	Contents
NOM-SIZE	TEXT 8	Nominal Size
WT/FT	REAL	Weight per foot
AREA	REAL	Cross Sectional Area
DEPTH	REAL	Depth of Beam
FLANGE-W	REAL	Flange Width
FLANGE-T	REAL	Flange Thickness
WEB-THK	REAL	Web Thickness

III. ARCHIVAL DATA

C. I BEAMS

Relation Name: "I"

Description: I beam data

Relation contents:

Attribute Name	Type	Contents
NOM-SIZE	TEXT 8	Nominal Size
WT/FT	REAL	Weight per foot
AREA	REAL	Cross Sectional Area
DEPTH	REAL	Depth of Beam
FLANGE-W	REAL	Flange Width
FLANGE-T	REAL	Flange Thickness
WEB-THK	REAL	Web Thickness

III. ARCHIVAL DATA

D. CHANNEL BEAMS

Relation Name: "CHN"

Description: Channel beam data

Relation contents:

Attribute Name	Type	Contents
NOM-SIZE	TEXT 8	Nominal Size
WT/FT	REAL	Weight per foot
AREA	REAL	Cross Sectional Area
DEPTH	REAL	Depth of Beam
FLANGE-W	REAL	Flange Width
FLANGE-T	REAL	Flange Thickness
WEB-THK	REAL	Web Thickness

III. ARCHIVAL DATA

E. ANGLE BEAMS

Relation Name: "ANG"

Description: Angle beam data

Relation contents:

Attribute Name	Type	Contents
NOM-SIZE	TEXT 8	Nominal Size
THICKNES	REAL	Thickness
WT/FT	REAL	Weight per foot
AREA	REAL	Cross Sectional Area

IV. AD-2000 TO RIM PROCESSOR RELATIONS

A. BEAM/ROD ELEMENTS

Relation Name: "BEAMS"

Description: Two-node elements

Relation contents:

Attribute Name	Type	Contents
CMPONENT	INTEGER	Level No. +1 as indicated by AD-2000 (Component #)
ELEMENT#	INTEGER	Element number within "BEAMS"
NODE1	INTEGER	Node #1
NODE2	INTEGER	Node #2
EL-TYPE	TEXT 8	Element type
NOM-SIZE	TEXT 8	Nominal size
MATERIAL	TEXT 8	Material

IV. AD-2000 TO RIM PROCESSOR RELATIONS

B. TRIANGULAR ELEMENTS

Relation Name: "TRIANGLS"

Description: Three-node elements

Relation contents:

Attribute Name	Type	Contents
CMPONENT	INTEGER	Level No. +1 as indicated by AD-2000 (Component #)
ELEMENT#	INTEGER	Element number within "TRIANGLS"
NODE1	INTEGER	Node #1
NODE2	INTEGER	Node #2
NODE3	INTEGER	Node #3
EL-TYPE	TEXT 8	Element type
MATERIAL	TEXT 8	Material
THICKNES	REAL	Thickness of element

IV. AD-2000 TO RIM PROCESSOR RELATIONS

C. QUADRILATERAL ELEMENTS

Relation Name: "QUADS"

Description: Four-node elements

Relation contents:

Attribute Name	Type	Contents
CMPONENT	INTEGER	Level No. +1 as indicated by AD-2000 (Component #)
ELEMENT#	INTEGER	Element number within "QUADS"
NODE1	INTEGER	Node #1
NODE2	INTEGER	Node #2
NODE3	INTEGER	Node #3
NODE4	INTEGER	Node #4
EL-TYPE	TEXT 8	Element type
MATERIAL	TEXT 8	Material
THICKNES	REAL	Thickness of element

IV. AD-2000 TO RIM PROCESSOR RELATIONS

D. NODE LOCATIONS

Relation Name: "NODES"

Description: Node numbers and coordinates

Relation contents:

Attribute Name	Type	Contents
NODE	INTEGER	Node number
X	REAL	X location
Y	REAL	Y location
Z	REAL	Z location

IV. AD-2000 TO RIM PROCESSOR RELATIONS

E. NODE CONSTRAINTS

Relation Name: "CONSTRN"

Description: Nodal constraints

Relation contents:

Attribute Name	Type	Contents
NODE	INTEGER	Node number
X-DISP	TEXT 4	Constrained in X-displacement?
Y-DISP	TEXT 4	Constrained in Y-displacement?
Z-DISP	TEXT 4	Constrained in Z-displacement?
X-ROT	TEXT 4	Constrained in X-rotation?
Y-ROT	TEXT 4	Constrained in Y-rotation?
Z-ROT	TEXT 4	Constrained in Z-rotation?

The text attributes will contain one of two values:

"N" --> this degree of freedom not constrained

"Y" --> this degree of freedom constrained

IV. AD-2000 TO RIM PROCESSOR RELATIONS

F. NODAL LOADS

Relation Name: "NODELOAD"

Description: Nodal temperatures and loads

Relation contents:

Attribute Name	Type	Contents
NODE	INTEGER	Node number
FMDIRECT	TEXT 4	Force or moment direction
APPL-FOR	REAL	Applied force or moment
TEMP	REAL	Nodal temperature
CONDNUM	INTEGER	Condition # for this data

IV. AD-2000 TO RIM PROCESSOR RELATIONS

G. ELEMENT LOADS

Relation Name: "ELEMLOAD"

Description: Element temperature or pressure loads

RIM relation contents:

Attribute Name	Type	Contents
CMPONENT	INTEGER	Level No. +1 as indicated by AD-2000 (Component #)
ELEMENT#	INTEGER	Element number
HEATLOAD	REAL	Element heat load
PRESLOAD	REAL	Element pressure load
CONDNUM	INTEGER	Condition # for this data

V. RIM TO SPAR PROCESSOR RELATIONS

A. CONFIGURATION FACTORS

Relation Name: "CONFACT"

Description: View factors

Relation contents:

Attribute Name	Type	Contents
IELEM#	INTEGER	Element# I
JELEM#	INTEGER	Element# J
VIEWFAC	REAL	Amount of heat energy leaving I and incident on element J
CONDNUM	INTEGER	Condition # for this data

VI. SPAR TO RIM PROCESSOR RELATIONS

A. STATIC DISPLACEMENTS

Relation Name: "STATDISP"

Description: Static displacement data

Relation contents:

Attribute Name	Type	Contents
NODE	INTEGER	Node number
X-DISP	REAL	Displacement in the x-direction
Y-DISP	REAL	Displacement in the y-direction
Z-DISP	REAL	Displacement in the z-direction
X-ROT	REAL	Rotation about the x-axis
Y-ROT	REAL	Rotation about the y-axis
Z-ROT	REAL	Rotation about the z-axis
CONDNUM	INTEGER	Condition # for this data

VI. SPAR TO RIM PROCESSOR RELATIONS

B. STATIC REACTIONS

Relation Name: "STATREAC"

Description: Static reaction data

Relation contents:

Attribute Name	Type	Contents
NODE	INTEGER	Node number
X-FORC	REAL	Force in the x-direction
Y-FORC	REAL	Force in the y-direction
Z-FORC	REAL	Force in the z-direction
X-MOM	REAL	Moment about the x-axis
Y-MOM	REAL	Moment about the y-axis
Z-MOM	REAL	Moment about the z-axis
CONDNUM	INTEGER	Condition # for this data

VI. SPAR TO RIM PROCESSOR RELATIONS

C. EIGENVALUES

Relation Name: "EIGNVALS"

Description: Eigenvalue data

Relation contents:

Attribute Name	Type	Contents
FREQ	REAL	Frequency
CONDNUM	INTEGER	Condition # for this data

VI. SPAR TO RIM PROCESSOR RELATIONS

D. EIGENVECTORS

Relation Name: "EIGNVECT"

Description: Eigenvector data

Relation contents:

Attribute Name	Type	Contents
NODE	INTEGER	Number
X-DISP	REAL	X-component of the eigenvector
Y-DISP	REAL	Y-component of the eigenvector
Z-DISP	REAL	Z-component of the eigenvector
X-ROT	REAL	X-axis rotational component of the eigenvector
Y-ROT	REAL	Y-axis rotational component of the eigenvector
Z-ROT	REAL	Z-axis rotational component of the eigenvector
CONDNUM	INTEGER	Condition # for this data

VI. SPAR TO RIM PROCESSOR RELATIONS

E. BEAM STRESSES

Relation Name: "BEAMSTRS"

Description: Beam forces

Relation contents:

Attribute Name	Type	Contents
CMPONENT	INTEGER	Component #
ELEMENT#	INTEGER	Element #
FORC1X	REAL	Force at end 1 in element x-axis direction
FORC1Y	REAL	Force at end 1 in element y-axis direction
FORC1Z	REAL	Force at end 1 in element z-axis direction
MOM1X	REAL	Moment at end 1 about element x-axis
MOM1Y	REAL	Moment at end 1 about element y-axis
MOM1Z	REAL	Moment at end 1 about element z-axis
FORC2X	REAL	Force at end 2 in element x-axis direction
FORC2Y	REAL	Force at end 2 in element y-axis direction
FORC2Z	REAL	Force at end 2 in element z-axis direction
MOM2X	REAL	Moment at end 2 about element x-axis
MOM2Y	REAL	Moment at end 2 about element y-axis
MOM2Z	REAL	Moment at end 2 about element z-axis
CONDNUM	INTEGER	Condition # for this data

VI. SPAR TO RIM PROCESSOR RELATIONS

F. PLATE STRESSES

Relation Name: "PLATSTRS"

Description: Stress resultants for 3 and 4 node elements

Relation contents:

Attribute Name	Type	Contents
CMPONENT	INTEGER	Component #
ELEMENT#	INTEGER	Element #
NXC	REAL	Stress resultant in x-direction at center
NYC	REAL	Stress resultant in y-direction at center
NXYC	REAL	Shear stress resultant at center
MXC	REAL	Bending moment about x-axis at center
MYC	REAL	Bending moment about y-axis at center
MXYC	REAL	Twisting moment at the center
QXC	REAL	Transverse shear at center on x-face
QYC	REAL	Transverse shear at center on y-face
CONDNUM	INTEGER	Condition # for this data

VII . CONCLUDING REMARKS

The schema presented in this report has been used for a wide variety of engineering applications. The schema is not completely fixed, however, since it is being updated as new attributes and relations are found to be essential in maintaining a complete data description.

VIII. REFERENCES

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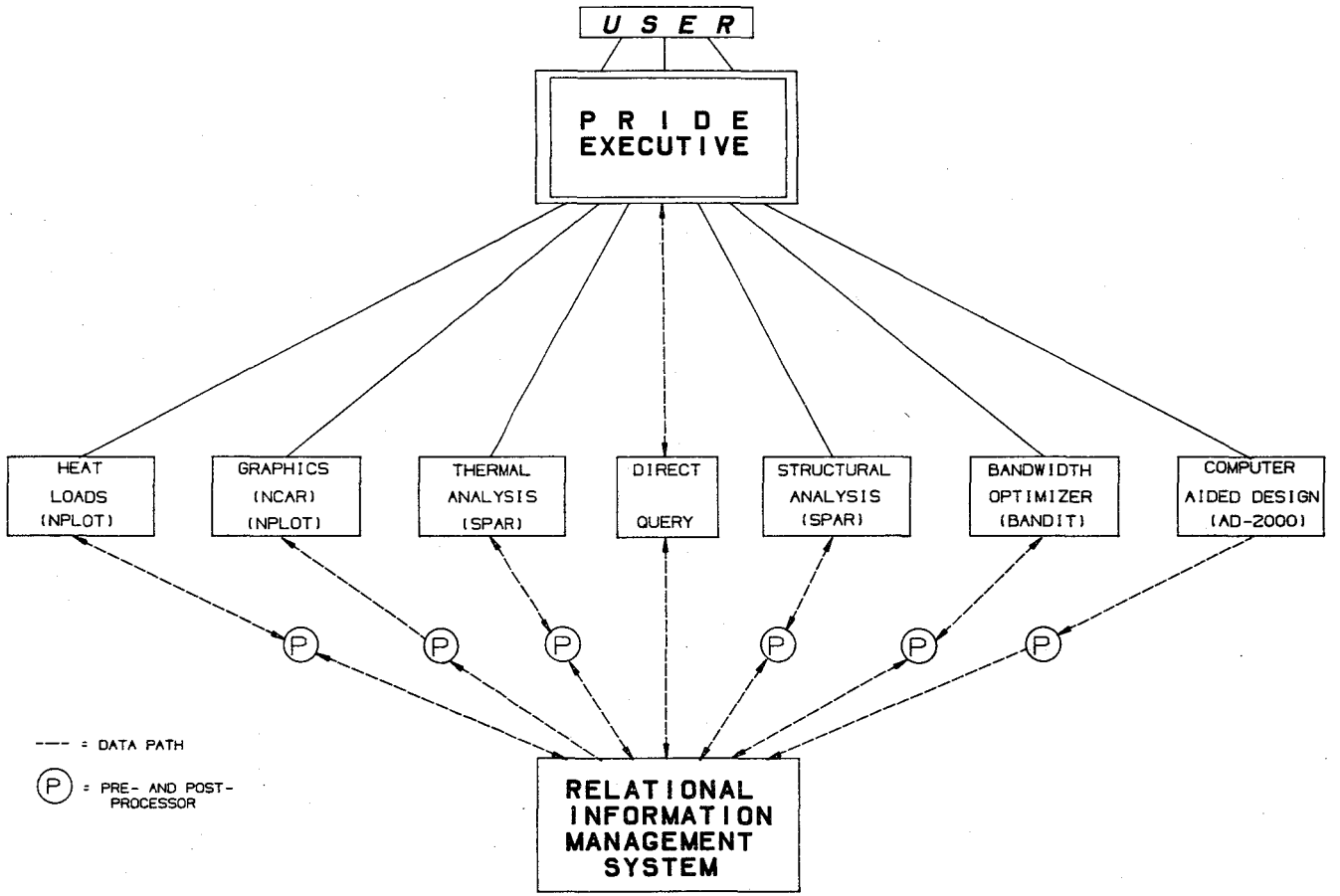

Figure 1. - An example of the role of the relational data manager.

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Final Report

16. Abstract

An initial description of an evolving relational database schema is presented for the management of finite element model design and analysis data. The report presents a description of each relation including attribute names, data types, and definitions. The format of this report is such that future modifications and enhancements may be easily incorporated.

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